

2009
ANNUAL HABITAT WORK PLAN



PARKER RIVER NATIONAL WILDLIFE REFUGE

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Parker River National Wildlife Refuge was established in 1942 primarily to provide feeding, resting and nesting habitat for migratory birds. The Refuge consists of 4,662 acres of diverse upland and wetland habitats including sandy beach, dune, Maritime shrubs and forests, salt marsh, man-made impoundments, and grassland habitats. These Refuge habitats support varied and abundant populations of resident and migratory wildlife species including more than 300 species of birds and additional species of mammals, reptiles, amphibians, insects and plants. The Refuge also supports nesting piping plovers, a federally listed threatened species.

Parker River also administers the Thacher Island National Wildlife Refuge, located off the coast of Rockport. Thacher Island historically supported a large tern colony, and has been managed in cooperation with the Town of Rockport and the Thacher Island Association since the late 1990s.

In 2006, we completed a Habitat Management Plan for the two Refuges, which will guide the management of the wildlife and habitats on the Refuges for the next 15 years. The goals, objectives, and strategies from the HMP are incorporated into this Annual Habitat Work Plan and will guide management for 2009.

A. Piping Plover and Least Tern Management

Habitat Objective

Work cooperatively with State (Sandy Point State Reservation) and local towns (Newburyport and Newbury) to protect from disturbance and degradation nine miles of nesting, staging, and foraging habitat for piping plovers and least terns. Through seasonal closures, predator management and public education, maintain a minimum productivity of 1.5 chicks per pair over a five-year period for piping plovers and a nesting least tern colony of 50-100 pairs.

2008 Management Prescription

Starting April 1, the Refuge closed the entire length of the Refuge beach to public access except for the 0.10 mile section north of Lot 1. To further minimize public disturbance, volunteer “plover wardens” are recruited to sit at the north and south end of the beach closure. Plover wardens prevent potential trespassers, educate the public about plovers and the role the Refuge plays in protecting this species, and report any trespass to Refuge staff. Sections of the beach are opened to public use as the chicks fledge. The southern portion of the Refuge beach (Lot 6 and 7) was opened on June 7th. The entire beach was re-opened on August 27th.

At Sandy Point, the beach area in between the two trails from the lower lot was symbolically fenced on April 1, and the symbolic fence was expanded throughout the summer to accommodate nesting plovers as the beach built up.

Monitoring of plover nesting activity began in late March with the arrival of plovers on Plum Island. Starting April 7th, surveys were conducted 2-3 times a week by walking the beach or using an All Terrain Vehicle (ATV). As the plovers establish pair bonds, begin

courtship and initiate territory defense, nest searches were conducted daily to locate the nest. Monitoring is conducted 2-3 times a week during incubating period, and 3-4 times a week until the chicks fledge (sustained flight of 100+ feet or 25 days of age). For failed nests, we survey the immediate area intensely to monitor re-nesting attempts and to locate the new nest.

Electric fences were used on the Refuge beach to protect a least tern colony and at Sandy Point to protect nesting plovers and additional nesting terns. Symbolic fencing was installed at the North End of the Newburyport Town beach on April 3rd. We used an enclosure to protect one nests on the Town beach.

The Refuge contracted with USDA's Wildlife Services to remove predators that might threaten nesting Piping Plovers. From mid-March through July, Wildlife Services conducted 12 nights of trapping and shooting removing 2 red foxes, 2 raccoons and 1 coyote from the Refuge.

We also conducted weekly shorebird surveys (April 7th-October 23rd) on the Refuge beach to monitor use during fall migrations. Surveys were conducted at various times during the day and at a range of tides by staff using ATVs.

Habitat Response

n/a

Response of Resources of Concern

Piping Plovers

During the 2008 nesting season, 15 pairs of piping plover and 30 pairs of least terns nested on Plum Island. The plovers produced 28 nests, 87 eggs, 20 chicks, and 13 fledglings. Four pairs (27%) successfully fledged young in 2008. Hatching success was 21%; fledgling success was 65% and overall productivity was 0.87 fledglings per nesting pair. With the exception of fledging success, all these measurements of productivity are down compared with recent years. The 5-year average productivity for Plum Island is 1.2 fledglings per pair. Predation was the major cause of nest failure during the 2008 season, accounting for 50% (14/28) of nest failures. High tides washing over nests, accounted for 25% of nest failures. In response to avian predation in past years at Crane Beach and Sandy Point State Reservation associated with the modified lobster trap enclosures, we continued to minimize the use of enclosures in 2008. When deemed critical, a mix of enclosure types was used. The total least tern population was approximately 30 pairs, spread over 3 colonies. Productivity was low (0.4 chicks per pair), but approximately equivalent to previous years (Figure 1).

For a detailed report on the plover and tern management program, see the 2008 Annual Plover and Tern Report.

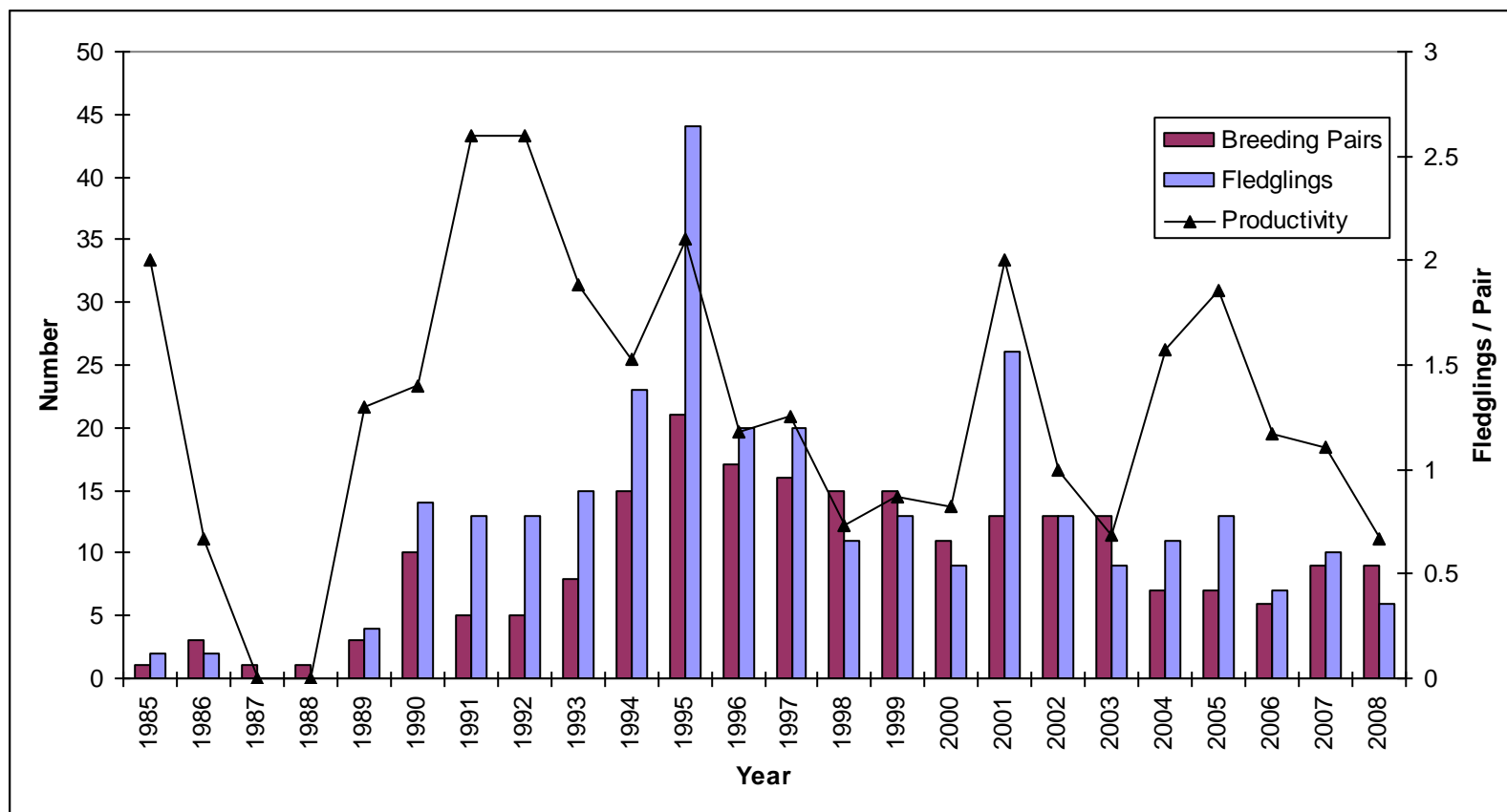


Figure 1. Breeding pairs of piping plovers and fledgling success at Parker River National Wildlife Refuge from 1985 to 2008. Productivity is calculated as number of fledged young per breeding pair. Plover productivity at Sandy Point and Town beaches are not included in the above figure.

Least Terns

There were two colonies on the northern end of the Refuge; Colony A stretched from mile marker 0.45-0.7 and Colony B nested between 0.82 and 1.3. These measurements represent the full range of nesting for these colonies. Colony A contained a high of about 15 pairs of least terns. Much of the colony was surrounded by electric fencing, in various configurations, beginning on July 8th. The fence provided an adequate protection from fox and coyote but weasel tracks were occasionally seen within the fence. It is not known if weasels contributed to nest loss. Colony B had about 9 pair of least terns and was not protected by electric fencing. Both colonies lost many nests to high tide washout. Neither colony had a successful nest until late in the season but combined they were able to fledge at least 8 chicks.

Sandy Point had a small colony with about 6 pairs located within the symbolically fenced area between the two access trails. The colony faced heavy nest loss from black-crowned night herons. Eggs were often found scattered and broken with their contents eaten. The least terns abandoned this site in late June. We believe that these birds moved to a new colony location on the Refuge at the 3 mile mark. This colony (Colony C) was surrounded by an electric fence shortly after their move. Predation did not appear to play a role in nest loss, however, two nests were lost to high tide washouts. Colony C was able to fledge at least 4 chicks.

Shorebirds

Fall shorebird migration started in late July on the Refuge beach, and peaked on August 18th, with 1,963 birds (see Figure 2). Over the season, the most abundant species were semipalmated sandpiper, semipalmated plover and sanderling. Concentrations of shorebirds were found throughout the Refuge beach, with roosting sites concentrated between Milemarkers 0.5 and 2.0.

2009: Management Strategy Prescriptions

- Close the Refuge beach beginning April 1, including beach access lots 2, 3, 6, and 7. Parking lots will remain closed while those sections of the beach still support nesting activity for plovers and terns.
- Working with DCR, Federal and State Endangered Species Programs, and towns of Newbury and Newburyport, further minimize disturbance of plovers nesting on town and State beaches by increasing signage and enforcement.
- Continue to contract with USDA to remove potential predators, including raccoons, skunks, red fox, grey fox and coyote prior to plover nesting season. Closely monitor predation on plovers and terns and target problem animals during the nesting season.
- Continue to use electric fence around tern nesting colony on Refuge beach and plover and tern nests at Sandy Point.
- Closely monitor nesting plover pairs, and adjust management (e.g. installing symbolic fencing, predator exclosure) as needed.
- On a case by case basis, evaluate the pros and cons of nest exclosures and install circular exclosures if risk of adult predation is low.

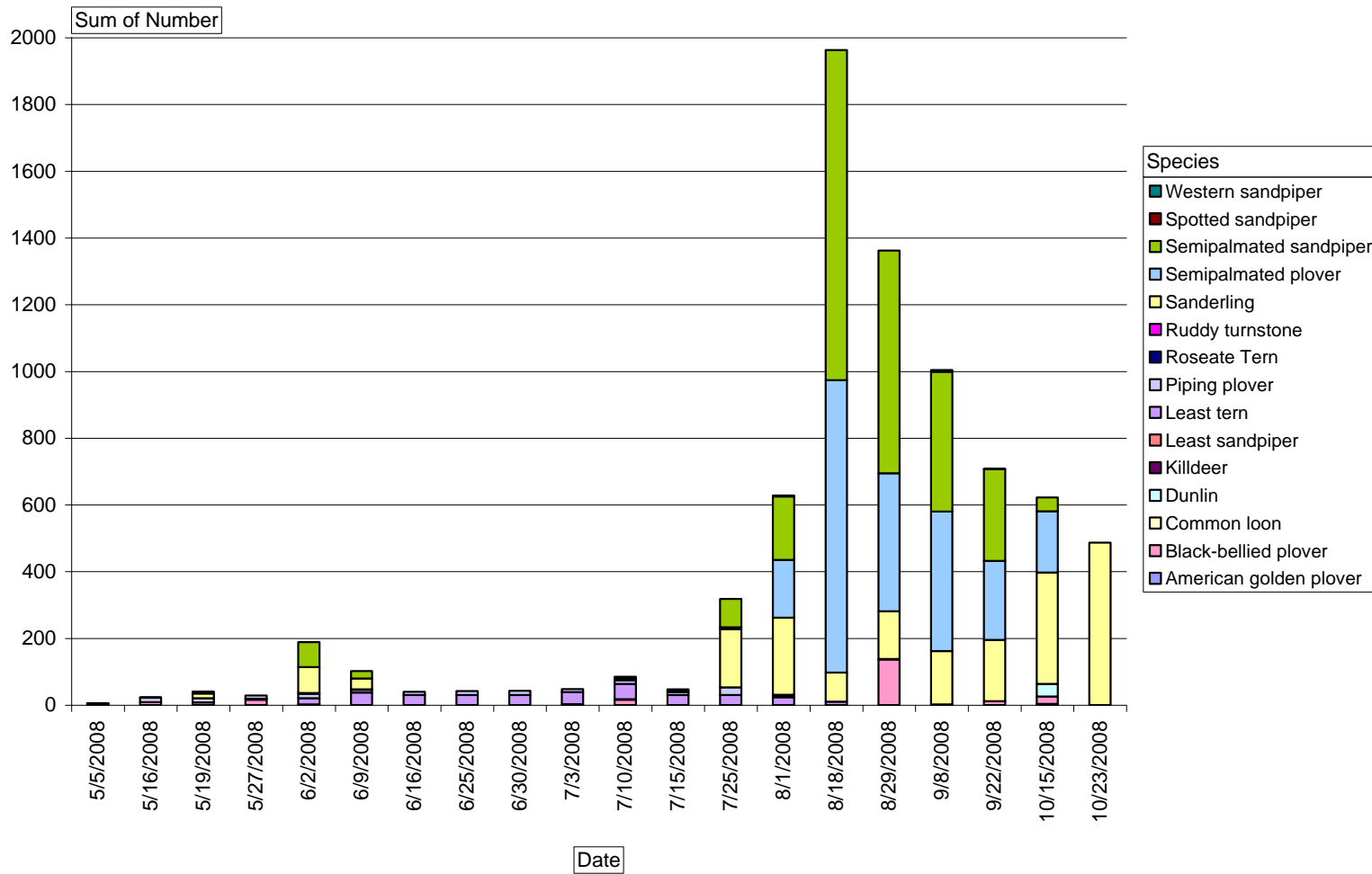


Figure 2. Summary of week shorebird surveys conducted on Refuge beach in summer/fall of 2008.

B. Maritime Shrubland and Forests

Habitat Objective

Manage 333 acres of maritime shrubland and forest to provide nesting and migratory stopover habitat for landbirds of conservation concern including eastern towhee, brown thrasher, prairie warbler, and to benefit the New England cottontail. Specific management objectives are:

1. Annually, maintain a minimum of 100 acres of maritime shrub and forest habitat with medium to high stem density (>10,000 stems/ha) to provide nesting and feeding habitat for eastern towhee, brown thrasher, and prairie warbler.
2. By 2021, increase native maritime shrub and forest communities (dominated by native fruit-bearing shrubs and trees, including shadbush, black cherry, arrowwood, beach plum, bayberry, and elderberry and comprising less than 5% invasive plants) to 50-100 acres to benefit fruit-eating migratory landbirds.

2008 Management Prescription

Monitoring and Surveys

Massachusetts Audubon has been running a spring and fall migratory banding station in the shrub habitat on the Refuge since 1998. The spring banding season began on April 1st and closed on June 2nd, with a total of 57 birding days. The fall banding season began on August 28th and closed November 1st, with a total of 55 banding days.

Shrub Adaptive Management Project

We initiated an Adaptive Management Project along with Rachel Carson, Great Meadows and Rhode Island National Wildlife Refuges to restore shrublands. The focus of Parker River's restoration is to improve native species diversity in the maritime shrublands and to provide optimal habitat for migrating songbirds. As part of this project, we will be restoring a 10-acre old field (south end of North Pool field), and a 6-acre maritime shrub unit.

Herbivore Management

The annual deer hunt was held on December 10th. Thirty five hunters participated in the hunt and harvested two deer.

Habitat Response

Invasive Plant Management

In 2008, stands of multiflora and rugosa rose along the roadside were treated with herbicide. These points will be monitored in 2009 and additional stands mapped and treated.

Shrub Adaptive Management Project

Rigorous monitoring began in 2008 in the two management units. A contractor selectively treated invasive plants in the maritime Shrubland unit. The efficacy of these treatments will be monitored in 2009.

Response of Resources of Concern

Invasive Plant Management

Shrub Adaptive Management Project

Monitoring and Surveys

In 2008, the Massachusetts Audubon banding station banded 80 species totaling 3,134 birds with a banding effort of 9,783 net hours. The most common species captured were Yellow-rumped warbler (479), gray catbird (324), common yellow-throat (302), white-throated sparrow (286) and magnolia warbler (215). Recapture data indicate that Parker River NWR is an important stopover area for migrating song birds, particularly during the fall migration. This is especially true for young birds (hatched the same year), as they make up 81 to 94 percent of all birds captured during the fall migration. Recapture data also demonstrate that birds exhibit significant weight gain during their stay, indicating that the Refuge is providing good stopover habitat.

Table 1. Number and species of birds banded at the Massachusetts Audubon banding station at Parker River Refuge from 2001 to 2008.

Year	Spring			Fall			Total	
	# sp	# bird	catch per effort	#sp	# bird	catch per effort ¹	# sp	# bird
2008	69	1670	35.55	64	1464	37.74	80	3134
2007	62	1832	56.32	70	1486	27.90	81	3309
2006	45	452	20.62	62	1396	33.63	70	1848
2005	48	930	42.31	66	1758	58.1	72	2359
2004	69	1361	51.00	66	2092	38.88	87	3453
2003	62	698	36 days*	45	881	39 days*	76	1579
2002	69	1473	63.8	57	1176	41.5	82	2649
2001	62	893	44.25	62	1484	59.67	76	2377

*net hours were not available in 2003 to calculate catch per effort

Proposal Year: Management Strategy Prescription

- Continue to partner with Massachusetts Audubon Society to monitor landbird use of maritime shrub and forest habitat during spring and fall migration through the banding program.
- Continue the annual one-day deer hunt program to maintain a sustainable deer population. Discontinue the Refuge check station as insufficient numbers of deer are harvested to obtain Refuge-specific biological data.

¹ Catch per effort is calculated as the total number of birds caught per 100 net hours. For 2003, catch per effort was not calculated as survey effort was recorded in days instead of net hours

- Monitor beaver activity for excessive tree felling and girdling. If negative impact on shrub habitat is determined to be excessive, remove problem beaver through trapping.
- Continue the shrubland adaptive management project and follow-up on post-invasive treatments.
- Control invasive plants through cutting, girdling, pulling, herbicide application targeting at eradication of certain early detection species (e.g. black locust, rusty willow, autumn olive, multiflora rose), and restoring areas of low invasion.

C. Exemplary Plant Communities

Habitat Objective

Maintain the native plant diversity, physiographic characteristics, and natural functions of the refuge's exemplary plant communities -- interdunal swale, sandplain grassland, and pitch pine dune woodland.

2008 Management Prescription

Cut Pitch pine stumps and branches were removed from the treatment area to facilitate the restoration project. No management was conducted in the interdunal swale or sandplain grassland due to lack of funding.

Habitat Response

N/A

Response of the Resources of Concern

N/A

2009: Management Strategy Prescription

- Remove 5-10 acres black pine forest to pitch pine dune woodlands.
 - Selectively cut black pines using chainsaw or heavy equipment (e.g. Geoboy), leaving select mature black pines to provide shelter for seedlings.
 - Plant pitch pine seedlings and saplings (up to 5 feet), spaced 15 to 20 feet apart during spring (April to June). Plants should be obtained from a local source if possible; check commercially available plants to ensure that parent stock are obtained from coastal Massachusetts, New England, or New Jersey. Water seedlings and saplings as needed for the first two months.
 - Monitor restoration sites for invasive plants and treat with backpack sprayer as needed.
- Treat Phragmites in Lot 2 swale through cut-stem and drop method, and monitor Galerucella beetle populations in swales; augmenting population as needed.

D. Salt Marsh

Habitat Objective

Annually, manage 2,660 acres of salt marsh, including a mix of high and low salt marsh vegetation comprised of less than 5% overall cover of invasive plants, and pool and panne habitat consistent with local reference sites, to ensure that the quality and natural function of the marsh are sustained and provide breeding habitat for Nelson's and saltmarsh sharp-tailed sparrows, and seaside sparrow, wintering areas for American black duck, and foraging areas for marsh and wading birds and migrating shorebirds.

2008 Management Prescription

Salt Marsh Integrity Index

Parker River is joining with other Atlantic coast refuges to create an index for assessing salt marsh health and ecosystem function based on physical, bird, nekton, and vegetation data. 2008 was the pilot years for this study. Three sites on the refuge were selected as study plots: Grape Island, Nelson's Island and an Open Marsh Water Management area at the Northern end of the refuge.

Mercury Bioaccumulation Study

Since 2004, Parker River has been participating in a multi-refuge, long-term salt marsh sparrow mercury bioaccumulation study. Because early investigations found Parker River Refuge to have the highest blood mercury among all salt marsh sharp-tailed sparrows sampled in New England, we have been investigating potential impacts to reproductive success and potential point sources of mercury in the Plum Island Sound watershed since 2006. We also collected foraging and nest characteristic data for the sparrows, and collected prey invertebrates to investigate potential contaminant pathway.

Monitoring and Surveys

Surveys conducted in the salt marsh include the salt marsh sparrow survey and the colonial nesting bird survey (coordinated by the State). The salt marsh sparrow survey was conducted three times during 2007: June 22, July 23, and August 14. The colonial nesting bird survey was conducted on June 12th.

Invasive Plant Control

The Refuge has been coordinating several community-based invasive plant control programs in an effort to eradicate these species from the Refuge and surrounding areas. In 2008, we:

- Implemented follow-up treatments on knotweed stands along the Plum Island Turnpike and at Sandy Point.
- Continued the community perennial pepperweed control project on the refuge and in the towns of Salisbury, Newburyport, Newbury, Rowley, Ipswich, Essex and Gloucester.
- Continued the partnership with Eight Towns and the Bay and Ducks Unlimited to control and study Phragmites in the Great Marsh.

Habitat Response

Invasive Plant Control

Japanese knotweed: Two knotweed sites totaling 3 acres received follow-up treatment in 2008. The sites were hand cut in the early summer with help from the YCC crew and volunteers. The stems were removed from the site for drying and disposal. In September when the plants had regrown about 1-2m high, there were sprayed with a 5% Rodeo solution applied with backpack sprayer.

The stands at Sandy Point have been 99% controlled. Re-sprouts were pulled in early June and sprayed with 5% Rodeo solution in late September.

Perennial pepperweed: 192 volunteers contributed 579 hours between May and August to control pepperweed both on refuge lands and in the Great Marsh region. A total of 8.75 acres were treated by volunteer hand-pullers. This protected over 280 acres of salt marsh from pepperweed. On the refuge, 3.45 acres were hand-pulled and 0.15 acres were treated with herbicide for 3.60 acres total treated.

Phragmites: In April 2008 a few *Phragmites* stands North of the Pine Island Creek were burned to facilitate herbicide treatment later in the season. In mid-September a contractor sprayed nearly all of the *Phragmites* stands that had been mapped for the project.

Response of Resources of Concern

Mercury Bioaccumulation Study

Between June and August of 2008, Refuge staff and volunteers spend 130 hours nest searching and found fifty-six active saltmarsh sharp-tailed sparrow nests and one suspected Nelson's sharp-tailed sparrow (*Ammodramus nelsoni*) nest during three nesting cycles.

Saltmarsh sharp-tailed sparrows returned to Parker River in late May, and immediately initiated nesting. Most females will re-initiate nesting after the first flood in late May/early June. As tidal cycles greatly affect nesting success, we divided the nests into cohort groups (nests that initiated incubation at roughly the same time) for the purpose of calculating reproductive success (see Table 2).

Table 2. Summary of sharp-tailed sparrow nesting at Parker River National Wildlife Refuge, 2008.

	Cycle 1	Cycle 2	Cycle 3
Nests Found	33	22	2
Search effort (hours)	54	49	49
Nests with Eggs	25 (84 eggs)	18 (56 eggs)	2 (5 eggs)
Nests Hatched	9 (30 chicks)	13 (40 chicks)	1 (3 chicks)
Nests Fledged	7 (16 chicks)	8 (25 chicks)	1 (3 chicks)
Hatching Success (%)	35.71	71.43	60.00
Fledging Success (%)	53.33	62.50	100.00
Productivity	0.64	1.39	1.50

Percent Predated	56.00	77.78	50.00
Percent Flooded	4.00	0.00	0.00
Percent Abandoned	12.00	5.56	0.00
Mean Nest Height (cm)	8.39 (n = 25)	9.41 (n = 16)	5.00 (n = 2)
Nests Females Hg Sampled	8	15	0

Nesting success at Parker River in 2008 was similar to 2007; however the hatching rate was much higher while the probability of a chick surviving to fledging was significantly lower ($p < x$). The low chick survival probability is likely attributed to the high predation rate of sparrow nests in 2008.

Although preliminary, the two years of productivity data suggest that adult blood mercury levels may be influencing sparrow reproductive success. Blood mercury levels were much higher in 2006 (2.26 ± 0.8 ppm) compared to 2007 (1.38 ± 0.4 ppm) (See Figure 3). Specifically, viability of sparrow eggs and fledgling success appear to be affected by mercury levels (Table 3).

Table 3. Mayfield probability of reproductive success for salt marsh sharp-tailed sparrows at Parker River and Rachel Carson NWR.

	Prob of nest surviving incubation [¥]	Prob of nest surviving to fledging [¥]	Hatching rate	Probability of nesting success [¥]
Parker River 2006	0.4164-0.4941	0.7486-0.8107	0.5322	0.17-0.21
Parker River 2007	0.3910-0.4735	0.8995-0.9370	0.7592	0.27-0.34
Rachel Carson 2006	0.7134-0.7791	0.4619-0.5730	0.8478	0.28-0.38

*Note: Due to lack of staff, insufficient nesting data was collected at Rachel Carson in 2007 to calculate Mayfield productivity.

[¥]Probability of survival is represented using 95% confidence intervals.

We capture 97 sparrows throughout the marsh in 2006 and 2007 in an effort to locate mercury hotspots within the Refuge salt marsh. The highest mercury levels were at the salt pannes, where we had been monitoring productivity for the past 2 years. The site with the lowest mercury level was found on the Essex County Greenbelt property directly north of the Refuge. In 2007, Biodiversity Research Institute sampled three sparrows at the Bill Forward Wildlife Management Area, located approximately four miles from the mouth of the Parker River, and found the highest level of blood mercury (1.53 ppm). From the distribution of mercury at sites sampled so far, it appears that there may be potential mercury source in the Parker River watershed. The site closest to the Merrimack River (the Greenbelt property) has the lowest in mercury, but we need to sample more sites adjacent to the Merrimack to rule out a potential mercury source.

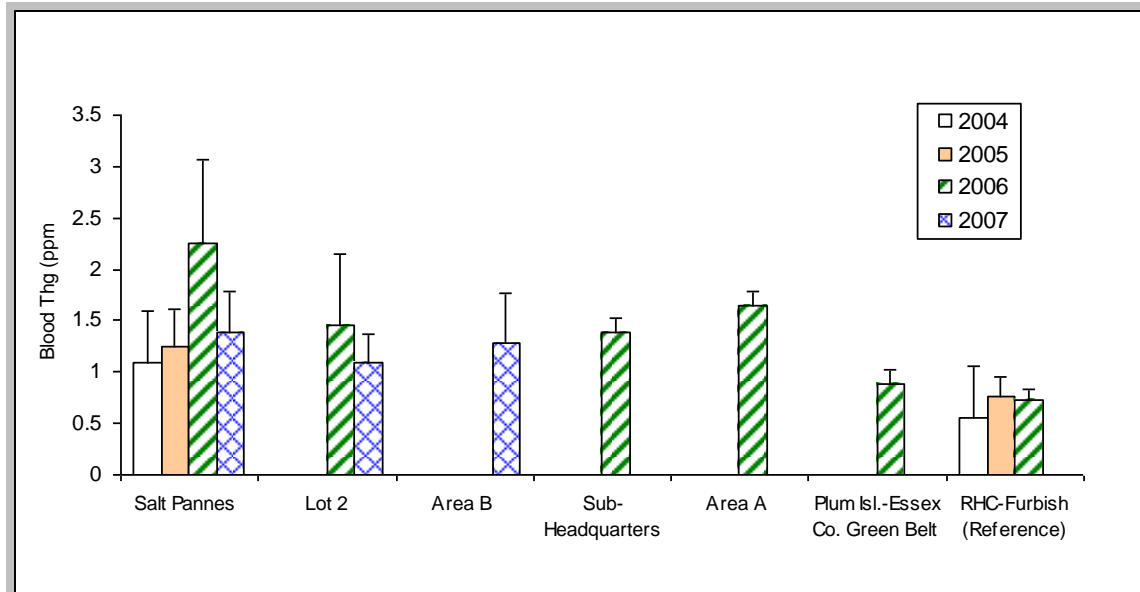


Figure 3. Blood mercury found in salt marsh sharp-tailed sparrow at various sites in and around Parker River NWR from 2004 to 2007.

Preliminary Hg data on invertebrates collected in June suggest that none of the invertebrate have abnormally high mercury levels (100-300 ppb), although spiders did have higher mercury loads compared to other groups (spiders=74 ppb, hoppers=4.7 ppb, caterpillars=0.66 ppb). Foraging observation found the sparrow to be feeding on spiders, Diptera larvae, and amphipods. Results of the remaining samples will help guide invertebrate sample next year to further investigate trophic pathway.

Monitoring and Surveys

The breeding tern population in the Plum Island Sound increased compared to recent years, particularly along the Plum Island River. Substantial colonies appear to be establishing on Pork Island and just south of Plum Island Turnpike.

Table 4. Common tern breeding pairs observed nesting in Plum Island salt marshes during the State count window (mid June) from 2002 to 2007.

Year	Woodbridge	Plum Island Sound Marshes	Total
2007	58	104	162
2006	67	50	117
2005	80	21	101
2004	96	26	122
2003	75	24	99
2002	80	24	104

For a fifth year in a row, the number of sharp-tailed saltmarsh sparrows detected during the annual breeding surveys continues to be high (Figure 4).

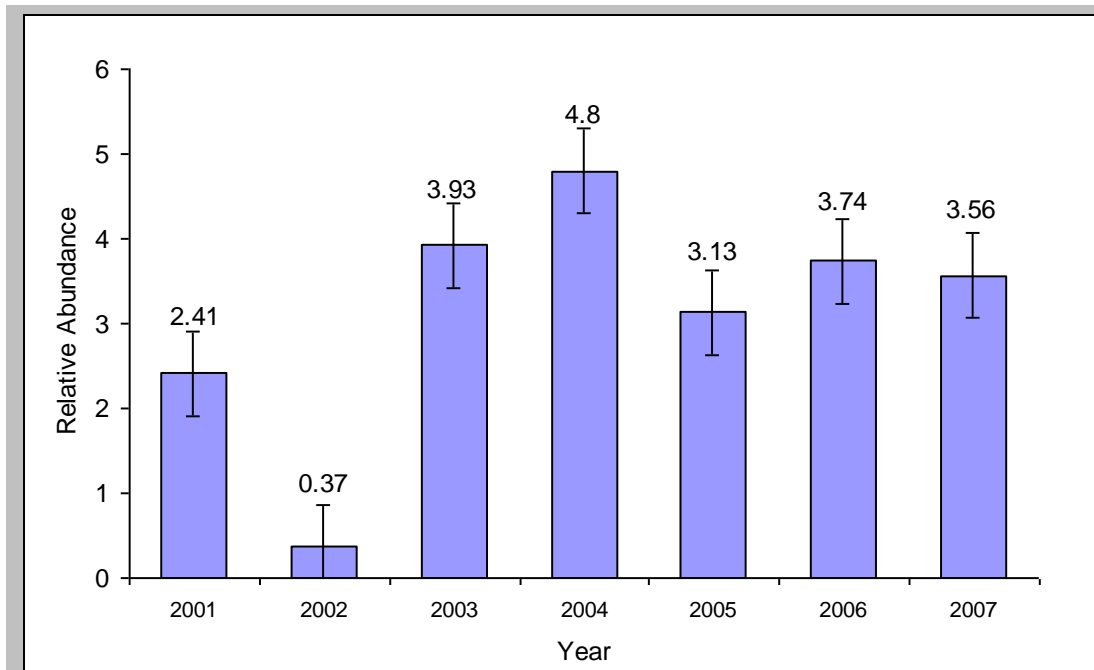


Figure 4. Relative abundance of sharp-tailed saltmarsh sparrow in call-back surveys, calculated as total number of individuals divided by total survey points. Three surveys were conducted for 2001, 2002, and 2007 breeding season. From 2003 to 2006, only one survey was conducted per year.

2009: Management Strategy Prescriptions

- Conduct three salt marsh sharp-tailed sparrow surveys, corresponding to the start of each breeding cycle.
- Continue to participate in the ongoing mercury bio-accumulation study in salt marsh sparrow, and seek additional funding to expand research to investigate the geographic and biological (species) scope of mercury and other contaminants (e.g. PCBs, organophosphates).
 - Continue to monitor the reproductive success of salt marsh sparrows and potential impacts from Hg.
 - Using color bands and radio-transmitters, monitor behavior and local movement of nesting female sparrows.
 - Continue to investigate trophic pathway of mercury levels in the salt marsh system, targeting spiders, Diptera larvae, and amphipods.
 - Conduct more in-depth foraging behavior observations to determine sparrow prey selection and foraging habitat.
 - Work with partners to investigate point sources for Hg along the Parker River.
- Continue to control invasive plant species (*Phragmites*, perennial pepperweed, Japanese knotweed) in the salt marsh through cutting, hand pulling, stem injection, and herbicide application (cut and drop or spot treatment).

- Continue off-Refuge Japanese knotweed control and treat all stands on Plum Island and along the turnpike.
 - Continue to control perennial pepperweed through the Great Marsh. Work with partners to the North and South to coordinate efforts.
 - Continue to treat emergent Phragmites in the salt marsh, and experiment with various treatment techniques.
- Continue to annually monitor common tern nesting colonies in Plum Island Sound as part of the State's annual colonial nesting bird surveys. As funding allows, increase monitoring of colonies to assess nesting success.

E Grassland and Early Successional Habitats

Habitat Objective

Manage 80 to 130 acres of grassland habitat with minimum size of 20 acres at a height of 8 to 12 inches during the summer to provide nesting habitat for grassland nesting birds, such as bobolink and northern harrier, and migration habitat for Lepidoptera, whimbrels, and other species.

2008 Management Prescription

Grassland and Early Successional Habitat Management

The Refuge has maintained 130 acres of grasslands through annual mowing to provide breeding and migratory habitat for grassland dependent species such as the Northern Bobolink, Savannah Sparrow, Meadowlarks and several species of raptors including Short-eared owls and Northern Harriers. The open field habitat include: the North Pool Field, south portion of the Bill Forward Field, Cross-Farm Hill, Stage Island Field, and Nelson's Island.

In 2007, we mowed the open fields from August 8 to September 5th. Due to shortage of staff resources, only half of Cross Farm Hill was mowed. The north portion of Bill Forward Field is maintained as early successional shrub habitat, and is mowed on a 3-5 year cycle. No management was conducted in this shrub habitat in 2007. The southern 10 acres of the North Pool Field was not mowed in 2008, allowing it to revert to maritime shrubland.

Artificial Nesting Structures

The Refuge maintains artificial nesting structures for two species, purple martin and ospreys, that have largely lost their natural breeding habitat. Purple martin colonies are located at three sites throughout the Refuge: at the old Refuge HQ located on the north end of Plum Island, the new HQ site, and the visitor contact station near lot #1. Osprey platforms are located at three sites throughout the Refuge: the end of the Pines Trail road in the salt marsh, on the south side of Cross Farm hill and at Nelson's Island.

Invasive Plant Management

On August 2, we spot treated small stands of spotted knapweed (totaling 2 acres) in grassland habitats throughout the Refuge with 1.5% Garlon. In mid September, we sprayed approximately 2 acres of leafy and cypress spurge in the Bill Forward shrub using 1.5% Rodeo. The treatment was timed with the second growth period of the invasive plant for maximum effectiveness. A photoplot was established to monitor long term control success.

Habitat Response

Invasive Plant Control

Control of spotted knapweed and multiflora rose has been found to be over 90% effective in past year, and is assessed visually. Photoplots were established to monitor control of leafy spurge.

Response of Resources of Concern

Grassland Nesting Birds

Grassland breeding surveys were conducted on June 23, July 7, and July 14th. Abundance of grassland breeding species was similar to that found in 2005. Bobolinks were the most abundant species breeding in the fields, with Cross Farm supporting the largest population (Figure 5). Red winged black birds is the second most abundant, with the largest population in the North Pool, and low numbers of Savanna sparrows were found, with the highest population at Bill Forward Pool. Savanna sparrow abundance was lower in 2007 (0.7 per survey point) as compared to 2005 (1.9 per survey point). One eastern meadowlark was observed in the North Pool field on July 7th. This species is an occasional breeder on the Refuge.

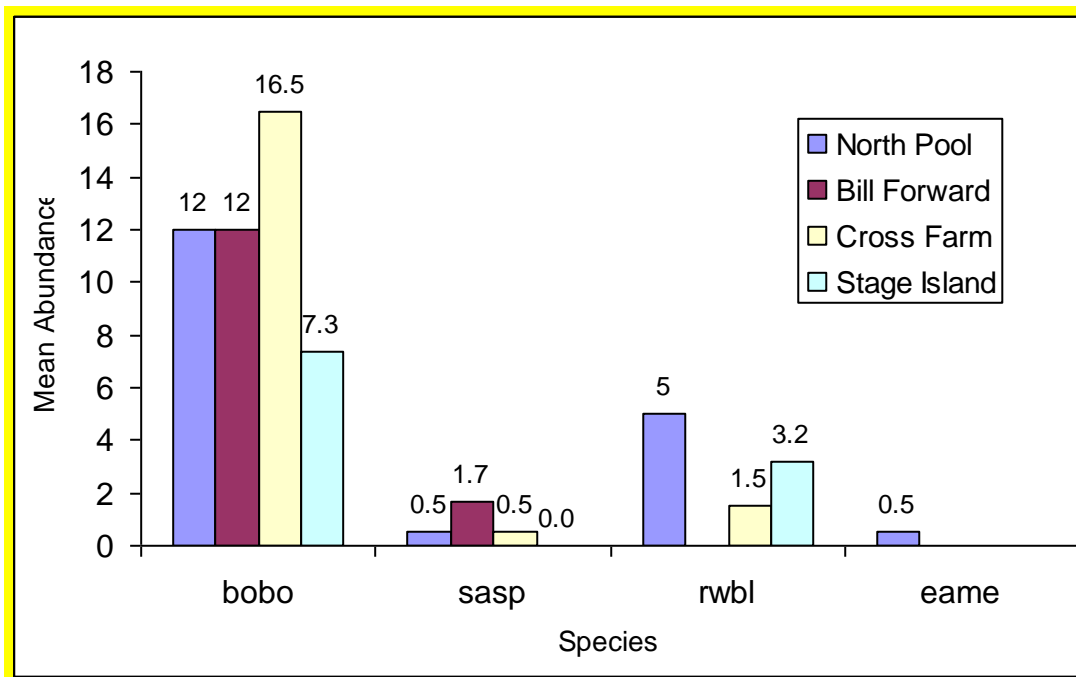


Figure 5. Grassland nesting bird abundance at North Pool field, Bill Forward Field, Cross Farm and Stage Island in 2007.

Artificial Nesting Structures

Volunteers monitor purple martin nest boxes for productivity once a week, and eject house sparrow nests. Although the number of nesting pairs is down in 2006 and 2007 compared to previous years, the total number of young fledged has been increasing the last four years. In the past two years, the fledgling rate has been 100%, compared to less than 50 in the prior two years. Nesting success of purple martins is largely dependent on weather as purple martins cannot feed during long periods of rain. The high fledgling rate the last two years can be attributed to good weather during the nestling stage.

Table 5. Productivity results from Purple Martin colonies at old HQ and Lot 1. The colonies at new HQ has never been occupied.

	2004	2005	2006	2007
nests with eggs	45	38	21	29
total # of eggs (E)	225	179	96	127
# of eggs that hatched (H)	163	101	71	82
% of eggs that hatched (H/E)	72	56	74	65
total # of young fledged (F)	61	50	71	82
% of young that fledged (F/H)	37	50	100	100
overall success rate (F/E)	27	28	74	65

2009: Management Strategy Prescriptions

- Mow grassland units after bird breeding season (July 31). Mow the Bill Forward Shrub in spring prior to start of bird breeding (May 1). Mow shrub islands harboring invasive plants, and follow up in fall with spot treatment of invasive shrubs.
- Let southern third of the North Pool Field revert to open shrub habitat. Monitor shrub regeneration and control invasive species (glossy buckthorn and morrow's honeysuckle) to ensure a native dominated vegetative community.
- Map and treat black swallowwort at Cross Farm; and continue spotted knapweed and leafy spurge control
- Install purple martin boxes at old HQ, new HQ, and Lot 1 in early April, and continue to monitor purple martin productivity using volunteers.
- Continue to conduct breeding bird surveys in grassland units.

F. Impoundment Management

Habitat Objective

Annually manage the three brackish impoundments (totaling 262 acres) to support spring and fall migrating shorebirds, spring and fall migrating waterfowl (American black duck), and breeding marsh and wading birds. Management prescription will change from year to year, dependent on wetland dynamics and vegetative composition, but will be directed to provide the following each year:

1. Migrating shorebirds: shallow (<10 inches water depth) to mudflat habitat with sparse (<15% cover) to no vegetation, at time of peak migration (late May and early August)/

2. Fall migrating waterfowl: shallow flooded (<12 inches) annual vegetation composed primarily of *Cyperus*, *Echinochloa*, *Polygonum*, *Bidens* and other seed producing moist soil vegetation at time of peak migration (late October to early November)
3. Manage for breeding wading birds (e.g. clapper rail, American bittern, king rail, least bitter, marsh wren, sora) and waterfowl (e.g. black duck, green-winged teal, gadwall) by maintaining water levels and controlling invasive plants.

2007 Management Prescriptions

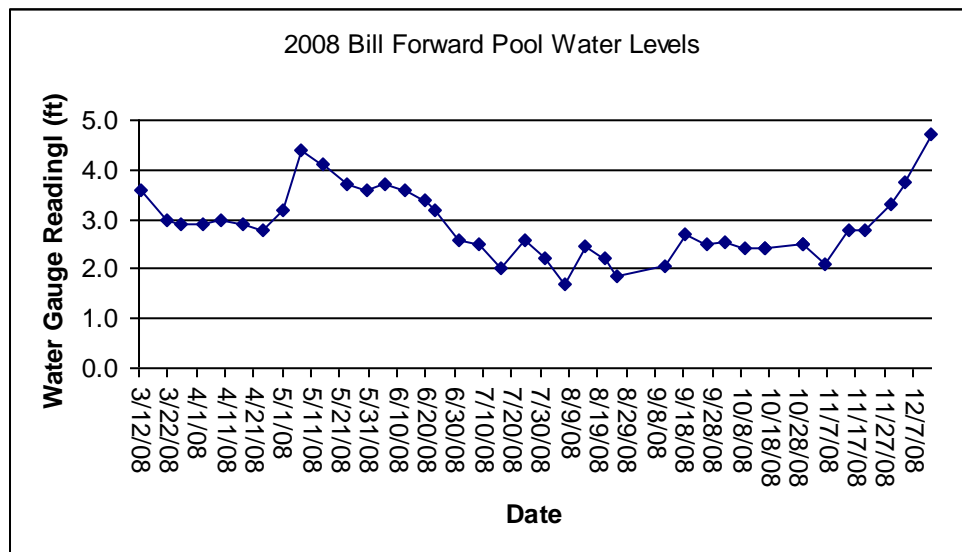
North Pool

In late summer/early fall, North Pool water levels were lowered in preparation for aerial Phragmites treatment. Water levels were allowed to naturally rise after treatment was complete. Call back surveys were conducted twice in the North Pool to monitor for breeding marsh and wading birds.

Regional Shorebird Impoundment Study

Bill Forward and Stage Island Pools participated in Year 3 of the R3/5 Impoundment Study. Bill Forward Pool received spring draw down for 2007. The objective was to expose the maximum mud flat and shallow water (< 10 inches) during peak spring shorebird migration (May 25). We started the draw down of the Bill Forward Pool using the new water control structure on May 7th. Due to heavy rain events in May and early June, water levels fluctuated between 2.5' and 3.5' late May to mid June, with a low water reading of 1.9 on June 20th. We re-flooded the impoundment starting mid-September. The impoundment froze on December 7 (Figure 6).

Stage Island Pool received the fall shorebird draw down for 2007. The objective was to provide waterfowl foraging during the spring migration and expose maximum mudflat



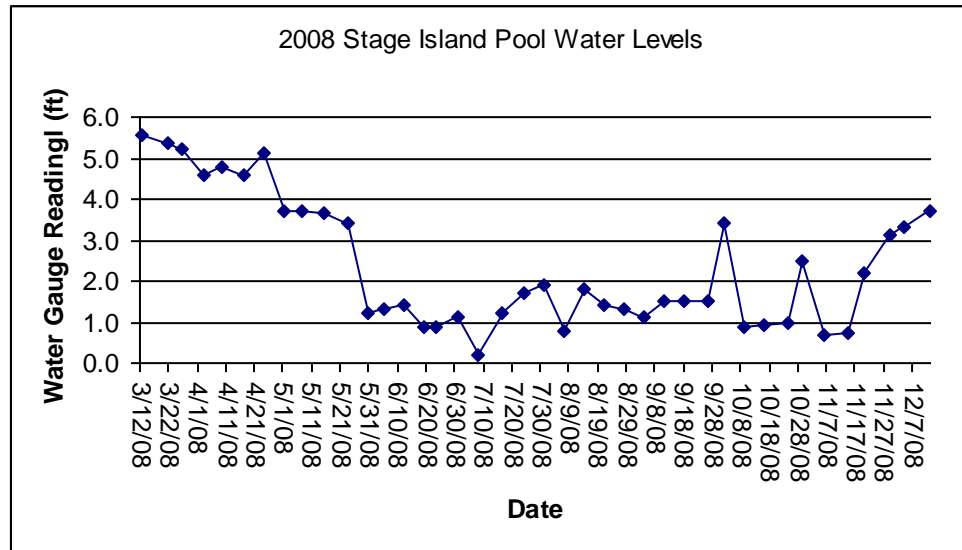


Figure 6. Water levels in the Bill Forward and Stage Island Impoundments through the 2008 field season.

and shallow water during peak fall shorebird migration (August 10). We started draw down in Stage Island on March 30, maintaining the water level at 3.0' for the spring waterfowl migration. For the fall shorebird migration, we started draw down on July 5, and flood up in late September. The water level was maintained between 0.9' to 2.0' for the fall shorebird migration and between 2.0' and 2.5' for the fall waterfowl migration. The impoundment froze on December 7 (Figure 6).

Habitat surveys conducted as part of the impoundment study include two vegetation cover surveys. We were not able to complete the species composition survey due to time constraints. To monitor waterbird response to the impoundment management, weekly surveys were conducted from spring melt to freeze up. In 2007, the Refuges participating in the Impoundment Study decided not to collect benthic and water column invertebrate samples because no treatment-related difference were observed from the previous two years of data.

Invasive Species Control

In September, Phragmites in the North, Bill Forward and Stage Island Pools were aerially sprayed with Rodeo. The Phragmites in Stage Island and Bill Forward Pools was then mowed in October and November. The water level in the pools was then raised to flood the flats where the Phragmites had grown.

We also continued to remove mute swans attempting to nest in the impoundments. In 2008, our Law Enforcement officers removed 8 mute swans.

Avian Influenza Monitoring and Waterfowl Banding

From August 14th through October 29th, waterfowl were captured in three swim-in traps and banding in the impoundments. Target species were tested for highly pathogenic avian influenza and samples were sent the National Wildlife Health Center.

Habitat Response

Vegetation Surveys in Entire Impoundment

Vegetation surveys of the entire impoundments found higher species richness² in the Stage Island Moist Soil unit in 2007 compared to previous years. Species richness for the Stage Island Robust Vegetation and Bill Forward remained constant in the past three years. Appendix A includes the complete list of plants found in the impoundments from 2004-2006.

In the Bill Forward Pool, the vegetation in 2007 is very similar to that found in 2005. The most abundant species include *Agrostis stolonifera* (31%), *Lythrum salicaria* (19%), and *Phragmites australis* (12%). The increase in freshwater plant species we observed in 2006 was not evident in 2007, suggesting that it was a result of the heavy rains we received in May and June of 2006. Robust monotypic plants (*Phragmites australis*, *Lythrum salicaria*, and *Typha latifolia*) have declined since 2004 but did not change between 2005-2007.

In Stage Island Pool, *Eleocharis parvula* increased dramatically in both the moist soil and robust vegetation areas, indicating that the fall shorebird drawdown is resulting in more open, sparse vegetation in the impoundment. The most abundant plants in the Stage Island Robust Area include *Eleocharis parvula* (27%), *Phragmites australis* (23%), and *Bidens connata* (6%). The most abundant species in the Stage Island Moist Soil area include *Eleocharis parvula* (31%) and *Typha latifolia* (14%).

Response of Resources of Concern

Monitoring and Surveys

A total of six marsh and wading species were detected during the call-back surveys in the North Pool in 2007. The most abundant and consistent species during the last three years were sora rail, Virginia rail, and least bittern (Figure 6). American bittern, common moorhen, king rail, and American coot also breed in the impoundment, but the number are low and variable from year to year.

² Species Richness shown are Heltshe's Jackknif Estimates based on observed species richness and sample size.

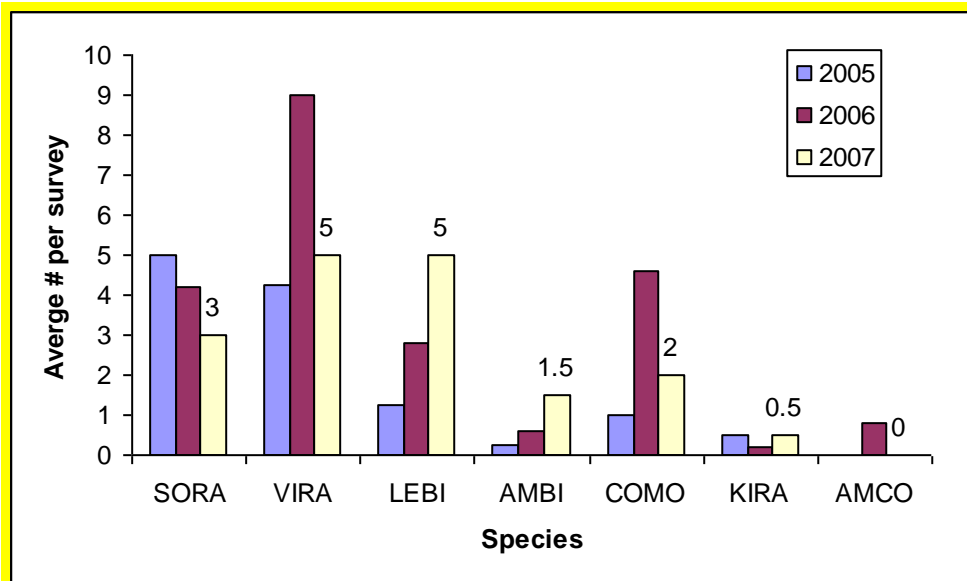


Figure 7. Breeding marsh and wading birds detected in the North Pool since 2005. 2007 average birds per survey is displayed in graph.

Regional Shorebird Impoundment Study

Peak waterbird use in both impoundments occurred during the fall shorebird migration (see Appendix B). Maximum bird use in Stage Island Pool, with 3,186 birds, was recorded on August 2. Maximum bird use in Bill Forward Pool, with 1,291 birds, was recorded on August 16. These dates were similar to that of last two years, with higher number of bird use in each impoundment, particularly in Stage Island Pool.

Shorebirds were by far the most numerous guild using the impoundments. Peak shorebird used was recorded in the Bill Forward Pool on August 16 (1,291), and in Stage Island Pool on August 2 (2,775), both dominated by SEPL, SAND, SESA and SBDO. Waterfowl was the second most numerous guild using the impoundments. Peak waterfowl use was recorded on November 8 in Bill Forward Pool (579 dominated by NOPI and ABDU) and in the Stage Island Pool (1044 dominated by NOPI, ABDU, MALL) (Figure 13). Wading bird use peaked on August 2 in Stage Island (76), but did not have peak abundance in the Bill Forward Pool.

Avian Influenza Monitoring and Waterfowl Banding

A total of 403 ducks were banded including 274 mallards, 46 American green wing teal, 67 American black ducks, 1 blue wing teal, 12 northern pintails, 2 mallard/black duck hybrids, and 1 lesser scaup. A total of 11 foreign recaptures and 110 local recaptures were recorded. 38 ducks were swabbed for avian influenza. All test results were negative for the H5 N1 strain of the virus but 6 birds were positive for other strains for avian influenza.

For detailed information about waterfowl banding and sampling in 2008, please see the Duck Banding Summary.

Proposal Year: Management Strategy Prescriptions

- Complete the Regional Impoundment Study by implementing spring waterfowl drawdown in Bill Forward in March. Continue to monitor waterbirds in both impoundments through the waterfowl migration.

BFP: *Spring Waterfowl, Fall Shorebird Migration Drawdown*

- Maintain full pool during winter months (until March)
- Starting early March, drawdown water levels during a 2-3 week period to provide spring waterfowl migration habitat. Maintain water levels (2.7') at an average depth of 12-18 inches for 2-3 weeks, then flood up to full pool (4.0') by early May.
- Maintain full pool from May until late June.
- Starting late June to early July, drawdown water levels (2.3') over a 6-8 week period such that shallow water (<10 inches) and mudflats are maximized at peak fall shorebird migration (late July).
- Maintain low water levels (1.8') from mid August to early September to encourage germination of moist-soil plants.
- Starting early September, start slow flooding of impoundment to maximize optimal water level (2.5') for dabbling ducks (12-18 inches) in later September and diving ducks (>24 inches, 3.5') in late October.
- Flood water level to full pool (4.0') prior to freeze date.

SIP: *Fall Shorebird, Spring and Fall Waterfowl Migration Drawdown*

- Maintain full pool during winter and spring months (until April).
- Starting mid April, drawdown water level (1.5'-2.0') during a 6-8 week period such that shallow water (<10 inches) and mudflats are maximized at peak shorebird migration (late May).
- Maintain low water (1.0') from mid June to mid August to encourage germination of moist-soil plants and growth of invertebrate population.
- Starting mid-August, start slow flooding of impoundment for the late shorebird fall migration and fall waterfowl migration. Maximize optimal water level (2.5') for dabbling ducks (12-18 inches) in mid September and optimal water level (3.0'-3.5') for diving ducks (> 24 inches) in mid October.
- Flood water level to full pool (5.0') prior to freeze date.

- Install staff gauges in relation to mean sea level at the North Pool water control structure.
- Continue to manage the North Pool to benefit breeding wading birds and waterfowl by maintaining high water levels through the breeding season (April – August). Continue marsh and wading bird breeding survey (4 surveys) in the North Pool.
- Monitor plant response to water level management using established vegetation plots in Bill Forward and Stage Island Pool according to 1994 monitoring protocols.

- Continue to band fall migratory waterfowl and conduct surveillance for avian influenza.
- Manage the robust vegetation area against invasive plants (i.e. Phragmites, purple loosestrife) and promote a mix of native wetland plants (e.g. cattail, asters, beggars tick).
 - Using water level manipulation, and if necessary aerial herbicide and mowing, manage against Phragmites and cattail in Stage Island and Bill Forward Pools. Treat Phragmites in the North Pool through aerial herbicide.

G. Thacher Island

Habitat Objective

By 2015, restore a colony of common and roseate terns to Thacher Island NWR by creating gull-free zones on the Refuge portion of the Island, removing predators, and providing optimal breeding habitat in an area not susceptible to storm surges.

2008 Management Prescriptions

Seven Refuge staff and volunteers conducted the annual gull nest census over two visits on June 4th and 11th. They counted 146 black-backed gull (GBBG) nests and 900 herring gull (HERG) nests and punctured 349 GBBG eggs and 2350 HERG eggs. They also counted 23 GBBG and 110 HERG chicks that had already hatched. On July 2nd, staff conducted a second nest count, and recorded 1 GBBG and 138 HERG renests. They punctured an additional 1 GBBG and 240 HERG eggs. 45 GBBG chicks and 127 HERG chicks had hatched between the two census windows.

Habitat Response

N/A

Response of Resources of Concern

The gull population at Thacher Island appears to have declined since we started the population control program in 2002.

2009: Management Strategy Prescriptions

- Conduct breeding gull census in late May and poke or addle all eggs found. Conduct follow-up survey in mid June to monitor success of addling efforts.

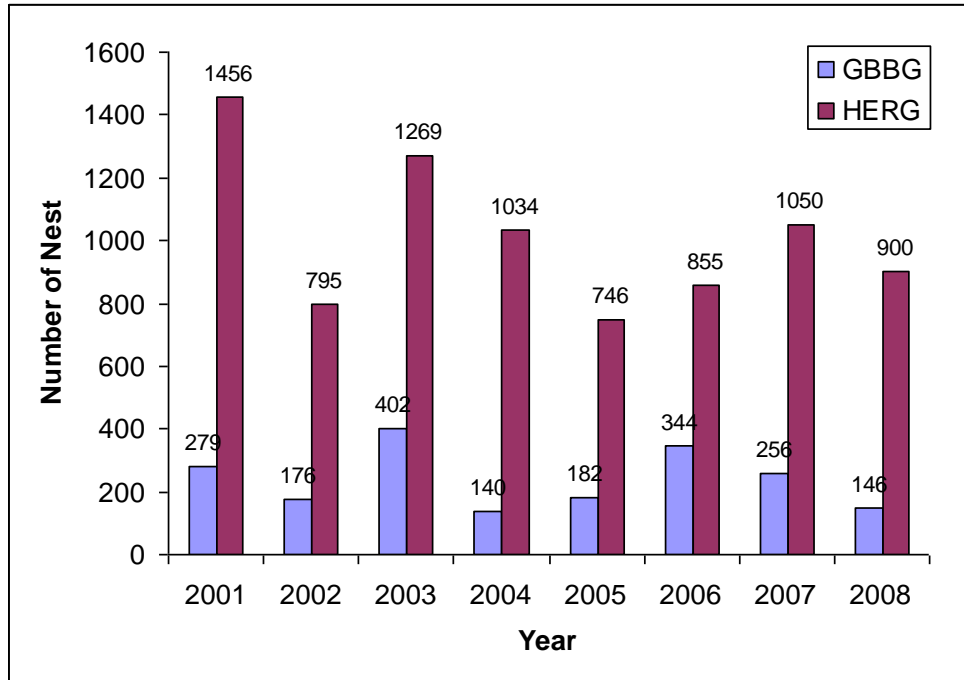


Figure 8. Breeding gull census at Thatcher Island. No eggs were punctured in 2001 or 2006.

Appendix A

Summary of Vegetation Survey in the Impoundments

Table A-1. Frequency of occurrence and percent abundance of plant species found in the robust vegetation area of the Stage Island Pool from 2004 to 2007

Species	2007	2006	2005	2004
Agrostis stolonifera			4.74	1.00
Atriplex patula			0.32	0.02
Bare Ground		33.67	15.80	21.45
Bidens connata	6.16	0.02	1.27	1.52
Calystegia sepium	0.11	0.13	0.32	0.20
Chenopodium rubra	1.01	0.80	0.03	
Cyperus esculentus			0.14	
Cyperus filicinus	0.07		0.46	
Eleocharis parvula	27.22	0.02	0.27	0.02
Erechtites hieracifolia	1.53	0.62	3.67	0.12
Gallium species	0.11	0.34	0.70	0.62
Hypericum species	0.18		0.49	
Impatiens capensis			0.14	
Juncus canadensis	0.04	0.04	0.46	0.18
Lythrum salicaria	1.46	1.13	3.40	3.97
Panicum dichotoflorum	2.77	8.95	34.35	
Panicum sp.			6.20	0.02
Parthenocissus quinquefolia			0.03	
Phragmites australis	22.53	17.43	30.41	13.76
Polygonum sp.		0.06	0.92	0.02
Rumex sp.		0.13	1.65	0.36
Scirpus americanus		0.34		0.73
Scirpus maritimus		4.42	3.92	
Scirpus pungens	0.33		0.89	
Spartina pectinata	0.18		2.87	1.48
Toxidendron radicans		0.02		0.15
Typha latifolia	4.17	6.80	8.91	8.39
Water		21.06		8.55
Wrack		0.84		22.65
Species Richness	25	19	27	23

Table A-2. Frequency of occurrence and percent abundance of plant species found in the Stage Island Pool, Moist Soil area from 2004 to 2007.

Species	2007	2005	2004
Agrostis stolonifera	3.82	2.10	0.08
Atriplex patula	0.08		0.25
Bare Ground	18.29	35.73	16.33
Bidens connata	3.05	1.23	2.10
Carex sp.			2.10
Chenopodium rubrum	1.97	0.08	
Cyperus esculentus	0.15		
Cyperus filicinus		6.72	
Cyperus strigosus		0.08	
Eleocharis parvula	30.88	8.62	
Erechtites hieracifolia	5.44	1.15	0.62
Galium tinctorium	0.15		0.53
Juncus sp.	1.15		0.08
Lythrum salicaria	1.76	2.58	1.15
Panicum dichotoflorum	3.58	10.87	
Panicum sp.		2.33	
Panicum virgatum			
Scirpus maritimus	0.38	0.70	1.23
Scirpus pungens/americanus	4.52	1.77	
Spartina alterniflora			
Spartina pectinada		3.27	
Spergularia maritima		0.62	
Phragmites australis	7.62	1.52	16.25
P. australis (dead)		4.05	
Typha sp.	14.44	17.63	32.32
Water	16.83	9.80	3.27
Species Richness	26	22	17

Table A-3. Frequency of occurrence and percent abundance of plant species found in the Bill Forward Pool from 2004 to 2006

Species	2007	2006	2005	2004
Agrostis stolonifera	30.53	11.14	30.00	13.48
Aster subulatus	2.85	3.36		
Aster tenuifolius		7.07		0.62
Atriplex patula	1.42	0.48	0.17	0.17
Bare Ground	7.80	2.45	16.27	
Bidens Conata	2.60	19.83	1.80	4.10
Calystegia sepium		0.36	2.43	1.85
Carex straminea		0.12	1.23	
Chenopodium rubra	1.77	0.48		
Convulvus arvensis		0.12		
Cyperus filicinus	0.08	0.12		
Cyperus strigosus		1.45	0.53	
Dodder				0.17
Echinochloa sp.	0.42	0.24		
Eleocharis parvula	20.95	4.07	29.13	19.30
Epilobium cilatum		0.74		
Erechtites heiracifolia	0.50	0.6	1.60	1.73
Erogostis sp.		0.86		
Gallium tinctorium	0.17	11.79		0.62
Hordeum jubatum		0.12	1.80	
Juncus canadensis		0.12	0.08	
Juncus gerardii			0.62	
Lycopus americanus	0.08	0.36	0.08	
Lythrum Salicaria	19.08	19.86	5.63	34.35
Panicum dichotoflorum	3.78	11.8	1.88	
Panicum virgatum				2.18
Parthenocissus quinquefolia				0.53
Phragmites australis	12.25	7.5	11.05	16.63
Pluchea purpurens	2.77	5.9	0.17	1.12
Polygonum spp		0.73		0.33
Polygonum punctatum		1.48		
Rumex sp.	0.08	0.12	0.70	0.08
Rumex verticillatus		0.12		
Schoenoplectus maritimus		2.5	0.53	4.80
Schoenoplectus pungens	2.68		1.88	6.38
Schoenoplectus sp.	10.68	2.5	2.41	11.18
Scirpus acutus		0.98		
Scirpus validus				0.08
Solidago sempervirens			0.17	
Symphyotrichum subulatum				1.43
Toxicodendron radicans				2.87
Typha spp.	5.12	5.05	6.12	9.63
Water			13.60	24.13
Species richness	24	35	22	28

Appendix B
Waterbird Use in the Impoundments in 2007